Questions from the State Board of Education

Responses from the Mathematics Initiative Team

July 28, 2006

1. The Mathematics Washington Assessment of Student Learning (WASL)

a. How difficult is the assessment? What does it cover?

The assessment is designed for hard-working, well-taught students. The highest level of the mathematical content on the High School Mathematics Assessment is covered in typical Pre-Algebra courses. Meeting standard means earning approximately 56% of the possible points.

Any hard working and well taught student that has been enrolled in Integrated Mathematics I, Integrated Mathematics II, or enriched Algebra and Geometry courses should have no difficulty meeting standard on the High School Mathematics Assessment. Some examples of the most difficult topics that are assessed on the High School Mathematics WASL include: understanding the Pythagorean Theorem; understanding perimeter, area, and volume; understanding dependent and independent probabilities; understanding measures of central tendencies; using variables to write or solve expressions, linear equations, and inequalities involving rational numbers; and graphing data or interpreting or describing graphed data.

b. What did the Achieve Study find?

Stated Purpose of the Report from Achieve:

> "The summary report was designed to help guide decisions the Washington State Academic Achievement and Accountability Commission would be making in the fall of 2004 and to provide information to OSPI that could help improve the WASL over time. This report is meant to provide the Commission, OSPI, and the Partnership for Learning with additional data and greater detail than was included in the October summary report."

Achieve was asked by the Washington State Academic Achievement and Accountability Commission, the Office of the Superintendent of Public Instruction, and the Partnership for Learning to analyze the WASL using a study similar to the June 2004 study of Florida, Maryland, Massachusetts, New Jersey, Ohio and Texas. Since the six-state report was released prior to the invitation to study Washington assessments, the methodology of the comparison of the six states had already been established.

The coding scheme developed for the six state tests focused on the mathematical content (EALR 1) of each item on the 2003 and 2004 Washington assessments and ignores EALRs 2–5, which are the process strands: Solves Problems, Reasons Logically, Communicates Understanding, and Makes Connections. Instead of looking at the testing of process, each process question was examined solely on the basis of its mathematical content and concludes that the "students are required to know mathematics content that is taught in the late 6th grade or early 7th grade internationally" (p. 26). In addition to ignoring process strands, the content strands were

rearranged to include only Number, Algebra, Geometry/Measurement and Data instead of Number Sense, Algebraic Sense, Geometric Sense, Measurement and Probability/Statistics. This rearrangement of content topics by Achieve makes the Washington assessment look inconsistent from 2002 to 2003.

Assessing process requires mathematical content, but the level of the mathematical content is at or below the grade being assessed so the level of difficulty of mathematical content does not mask the ability of the student to demonstrate proficiency in the process strand being assessed.

The study also looked at the cognitive demand of each item and concluded that the 2003 Washington was at the bottom of the seven states even though difference in the numbers from the top state (Maryland End-of-Course Algebra Exam) was fairly small (2.98 - 2.45 = 0.53) and the investigators could not tell us what the numbers signified.

Conclusions:

1. Use the results of this report to silence the critics that say the Mathematics WASL is too difficult to expect all 10th grade students to meet standard.
2. Do not use the results of this report as a guide to improve the WASL. The criteria used to analyze the difficulty of the test do not match the criteria used to construct the assessments. It is similar to using a set of criteria for building a boat to assess an airplane. Many of the materials to build the boat and airplane are the same but the criteria for success are entirely different.

National Assessment of Educational Progress (NAEP) provides an additional lens to compare proficiency in mathematics among states in the Achieve Study. The WASL scores are closer to NAEP scores than the other states indicating alignment of NAEP standards and EALRs.

Achieve Report Schools

NAEP Scores Grade 8 and State Standardized Testing Scores Grade 10

State	% Proficient NAEP Grade 8	% meeting State Standard H.S. (Self-Reported 2005)
Florida	26	77
Maryland	30	53.8 (Alg I)*
Massachusetts	43	61
New Jersey	36	74
Ohio	34	90.7
Texas	31	?
Washington	36	47

*Maryland's test is an "end of course" Algebra I exam.

c. Are there cultural barriers in the mathematics test?

Any cultural barriers are eliminated during a review by the Bias and Fairness committee. This committee makes recommendations to the Office of Superintendent of Public Instruction mathematics team about which items need to be revised or eliminated based on their opinions. Also, during the Content Review with Data committee meeting, all items are analyzed after piloting as to which items are biased for or against certain groups. These items are then revised and repiloted, removed permanently, or left in the item bank.

Some data over the last decade has shown some slight statistical advantages to different groups. For example, the data shows that white males generally perform better (higher p-values) on multiple-choice items than females; females and minorities perform better (higher weighted p-values) on constructed-response items than white males.

2. WASL Results

a. We need to disaggregate the results by race, ethnicity, language, immigrant status.

Please see attached data.

b. What is the geographic distribution of the results?

We do not have this data at this time.

3. Instruction

a. Are students getting a foundation in middle school?

It really depends on the district, school, teacher and instructional materials. We have no systematic data on how many districts have aligned their instructional materials and the EALRs using a systematic and thorough process.

The alignment process varies from district to district resulting in misalignment and misconceptions of the EALRs. Not all students have the same opportunity to receive quality mathematics instruction because of these alignment processes. Often the curriculum is seen as the book or directed by district office using a strict pacing guide that doesn't allow for individual classroom and student needs. Often material is covered but concepts are not learned. Just because we have sound standards doesn't mean that those get taught nor does it mean that concepts are taught appropriately.

Math Helping Corps (MHC) staff members report that there are some major deficiencies in the content knowledge of middle school staff. Good standards can't make up for that in most cases.

MHC staff members have seen too many teachers who do not implement a mathematics program with fidelity and then attribute poor results to the program. Buying a "good" textbook does not compensate for poor teacher preparation.

A teacher survey suggested that pre-service teachers need more mathematics methods courses and courses that familiarize them with the EALRs, GLEs, and Test and Item Specifications.

b. What are other countries doing?

Other countries teach for depth and understanding by including fewer concepts but teaching to a greater depth of understanding.

Some countries track students so that only the best move on to the college track. However, that shouldn't be used as an excuse for doing poorly. We don't see it mentioned as much because there are also plenty of examples of successful students in other countries who are not on the college track and they outshine the United States in some areas.

In many places, including Singapore, students have skills down cold but are looking at ways to improve problem solving. In Japan, teachers have intensive collaboration and planning time to develop quality lessons on how to teach a particular concept – teaching lessons in the morning, debriefing the lesson in afternoon. Time is spent looking at what went well and where improvement needs to be made.

Other countries have clear and consistent standards that teachers support and for which they are held accountable.

How do we compare with other countries?

According to the 2003 Program for International Student Assessment (PISA), testing 15-year-old students, in both 2000 and 2003, about two-thirds of the other participating OECD countries outperformed the United States in the content areas of space and shape (geometry) and change and relationships (algebra).

According to the Trends in International Mathematics and Science Study (TIMSS), 8th grade students in the United States exceeded the international average as well as average scores of their peers of 25 of 44 other countries. United States students showed improvement of 12 points in average mathematics scale scores from 1995 to 2003 (p. 7). Five other countries made greater improvements than our students.

c. To what extent are mathematics skills taught in an applied manner?

See answer to "1a". It really depends on the teacher, instructional materials used, and/or materials used for supplementing.

d. What can we learn from the wealthier school districts?

Higher expectations in wealthier school districts?

Duane Baker's (BERC – Baker Evaluation, Research, and Consulting) work makes it very clear that the only thing they found to compensate for the socio-economic disadvantaged student is quality teachers teaching well.

According to the BERC study, qualified teachers incorporate the four components of Powerful Teaching and Learning into their work:

1. Personal learning experiences – teachers experienced classrooms that actively engaged them in learning with reflection time and application of the learning in relevant context.
2. Modeling – teachers observed quality teaching from master teachers and questioned them about their instructional techniques.

3. Professional development learning – teachers took advantage of opportunities that coincided with the state reform effort. These teachers accepted the standards, frameworks, benchmarks, GLEs for ***all*** students.
4. Open classrooms – teachers have not taught in isolation.

We need to put our best teachers in the more challenging schools. Many times it works the other way around.

More time with parents in wealthier school districts?

Do those teachers have higher expectations or is it that parents, teachers, principals, district office staff have higher expectations? Parental involvement is higher as is their ability to assist their children. Parents have higher education expectations along with resources to assist their children, either personally or with tutors.

More qualified teachers in wealthier school districts?

We do not have this data at this time.

e. We need to look at time and learning and the opportunity to learn.

Students need to have an average of at least 75 quality minutes of mathematics instruction every school day (180 days). According to a recent informal survey of 7th grade teachers, most mathematics instruction is done in 41–55 minutes each day, hardly the 75 minutes that have been suggested. At elementary schools reading is taught for 90 minutes in the morning then mathematics is usually taught in the afternoon. Not a quality time to teach. An informal survey of 66 Washington teachers who attended 3rd and 4th grade mathematics scoring in Mesa, Arizona was taken. The responses to "How many minutes a day do you teach mathematics?" and "When do you teach mathematics: morning or afternoon?", showed most of those teachers taught mathematics in the afternoon and for no more than 45 minutes a day!

Schools need to make sure that struggling students get the best mathematics teachers and that all students take quality classes instead of a class that is so remedial they will never get to the GLEs for their particular grade. This only reduces their chance of being successful on the WASL.

A lot of resources have been put into reading and writing – block classes, 90 minutes of instructional time, remediation if students are not performing at adequate levels, statewide Reading First program, etc. These same types of resources need to be provided for mathematics instruction.

Students who are not performing at grade level need to be provided with extra time. Schools need to make sure that students get core instruction plus extra support. All students should be doing work at their grade level and their instructional level. Teachers need to know how to differentiate instruction for students at different levels – more teacher professional development.

Any student reported as not meeting standard in grades 4 or 5 should be provided double mathematics courses beginning in grade 6. Of course, these courses need to be with high quality instructors and materials, not just more of the same.

The attitude that mathematics illiteracy is okay needs to change. People will not tell you they can't read, but they are more than willing to say they don't do mathematics. That is not okay. The ability to do mathematics is not genetic.

report prompted a review of the current knowledge and skill competencies for preparation of mathematics teachers. OSPI is currently in the process of implementing a new collection system which will allow for the identification of what a teacher is actually teaching and what they are certified in.

PESB will be adopting new endorsement competencies for both K–8 and Middle Level Mathematics/Science in September.

5. How often is the alternative certification route used for mathematics teachers?

About 25% of Washington's alternative routes program completers have exited with endorsements in mathematics or middle level mathematics/science. A brief prepared by PESB last year stated that in the three years the program has existed, 53 have earned mathematics endorsements and an additional 61 have earned middle-level mathematics/science endorsements.

b. What is possible regarding short-term, intensive teacher training?

If the question means pre-service training, it exists – the Alternative Routes Program. It is performance-based, so its length varies. It's as long as it is necessary for the individual to demonstrate they have met standards for certification. The program consists of an intensive summer academy followed by a full-time classroom-based mentored internship.

If the question means intensive training for existing teachers, the answer is that there is nothing at present.

Data regarding the number of 2005–06 Alternative Routes Program completers who earned mathematics or middle level mathematics/science endorsements will be available at the end of August. It is estimated that there will be another 30–40.

6. <u>Graduation Requirement</u>

a. How many mathematics credits are required?

Two years, with no specific requirements for those two years.

b. What number of mathematics credits should a student have to be college and/or career ready?

The short answer is four years, just like Language Arts. For most students the appropriate courses are Integrated I and Integrated II to fulfill the two year mathematics requirement and to meet standard on the WASL. Beyond this level, advanced mathematical concepts and skills are more appropriately learned in context of a career path, for example, college preparatory, Career and Technical Education, or Cooperative Education.

"Results of a new ACT study provide empirical evidence that, whether planning to enter college or workforce training programs after graduation, high school students need to be educated to a comparable level of readiness in reading and mathematics. Graduates need this level of readiness if they are to succeed in college-level courses without remediation and to enter workforce training programs ready to learn job-specific skills."

From Ready for College and Ready for Work: Same or Different? 2006

7. Improvement Strategies

a. Would the reading improvement model be applicable to mathematics?

The Mathematics Initiative Team is in the process of trying to hire someone to lead in the development of this document.

b. Are there any hooks on the remediation dollars that would be helpful?

We would like to refer to these as interventions, not remediation.

Any intervention dollars should be linked to diagnosis of the topics being studied in regular classes. All intervention courses should require a complete syllabus to be designed before the class begins. These must include goals with smaller learning targets sequenced so that a teacher can differentiate instruction for all students. A committee needs to be convened to approve all syllabuses designed, with feedback on how to improve, and time for teachers to share and ask each other questions.

No intervention dollars should be allowed to pay for supplanting of classes. It must be spent on supplementing the already required courses and time spent on mathematics.

No funding should be provided unless the intervention courses are taught by a highly qualified instructor who is certified or endorsed in mathematics. Another option that could be used in place of this or along with it is that funds to purchase instructional materials, including software, may be used for purchasing from an OSPI approved menu of materials and the instruction is guided by a trained educational assistant or volunteer.

c. Can we come up with something that will work in the next 18 months? How about robust remediation? It will be difficult to "innovate out" in the timeframe that is available.

Goal: Increase student performance on the Washington Assessment of Student Learning (WASL) in mathematics by developing a unified, standards-based curriculum infused with cognitively complex problems.

Professional Development

- Involve educators in courses that allow Essential Academic Learning Requirements (EALRs) and Grade Level Expectations (GLEs) to come alive in classrooms.
- Increase mathematics capacity for teaching mathematics—mathematics improvement will begin and end in the classroom.
- Increase teacher skills and knowledge in how to do daily diagnosis and intervention with all students based on how students learn mathematics.
- Train teachers to develop and/or adapt cognitively complex problems to use with appropriate lessons or units.

Time on task

- Elementary School – Students will spend a minimum of 75 minutes per day for 180 days of the school year.
- Middle School – Students will spend one class per day at grade level in mathematics. Students who do not meet standard on the WASL will take an additional daily mathematics intervention class until the student meets standard two years in a row.

- High School - Students will spend one class per day at grade level in mathematics. Students who do not meet standard on the 7th or 8th grade WASL will take an additional daily mathematics intervention class until the student meets standard on the WASL.

Quality Mathematics Instruction

- High School Credit for two years of mathematics must be equivalent to Integrated Mathematics I and Integrated Mathematics II.

d. What should the Board do?

The State Board needs to continue to hold superintendents accountable for existing rules and regulations that delineate time for mathematics instruction. They also need to take a proactive role in the next legislative session to recommend full financial support for mathematics professional development that is focused, sustained, and job-centered. They also need to recommend funding of quality time for teachers to learn both mathematical content and how to teach mathematics, thus providing all Washington students an opportunity to learn rigorous mathematics.

What should OSPI do?

The Mathematics Initiative Team under the guidance of Superintendent Bergeson, needs to communicate with one voice and to coordinate professional development for all mathematics educators, complete the activities listed in the Mathematics Initiative, become actively involved in educating parents and business groups about what the EALRs really are, and become the source of reviewed information about mathematics.

What should the Legislature do?

The Legislature needs to hold superintendents accountable for sound, quality mathematics instruction in all classrooms thus providing all children an opportunity to learn mathematics in classrooms with instruction aligned to the EALRs. They need to make mathematics a top priority and demonstrate their commitment to improvement mathematics knowledge and skills of both students and teachers by fully funding and evaluating professional development, beginning with First Steps and Developing Mathematical Ideas for all high school mathematics teachers and moving on to include elementary and middles school teachers. They need to mandate and fund doubling of mathematics instructional time for students that do not meet standards. These courses must include targeted intervention aligned with the EALRs that supports classroom instruction. They can not be homework sessions.

What should community groups do?

Leaders in the community can: provide venues for ongoing conversations about mathematics in the state of Washington; express the absolute necessity of mathematics for jobs and citizenship; help dispel the myth of the "mathematics mind"; support local schools with volunteerism. Parents need to send students to school ready to learn and particularly support mathematics as a program.